
# Colorado Legionnaires' Disease Outbreaks: Lessons Learned

COLORADO
Department of Public Health & Environment

Legionnaires' Disease Conference
Salt Lake City, UT
June 27, 2019

# Contact Info

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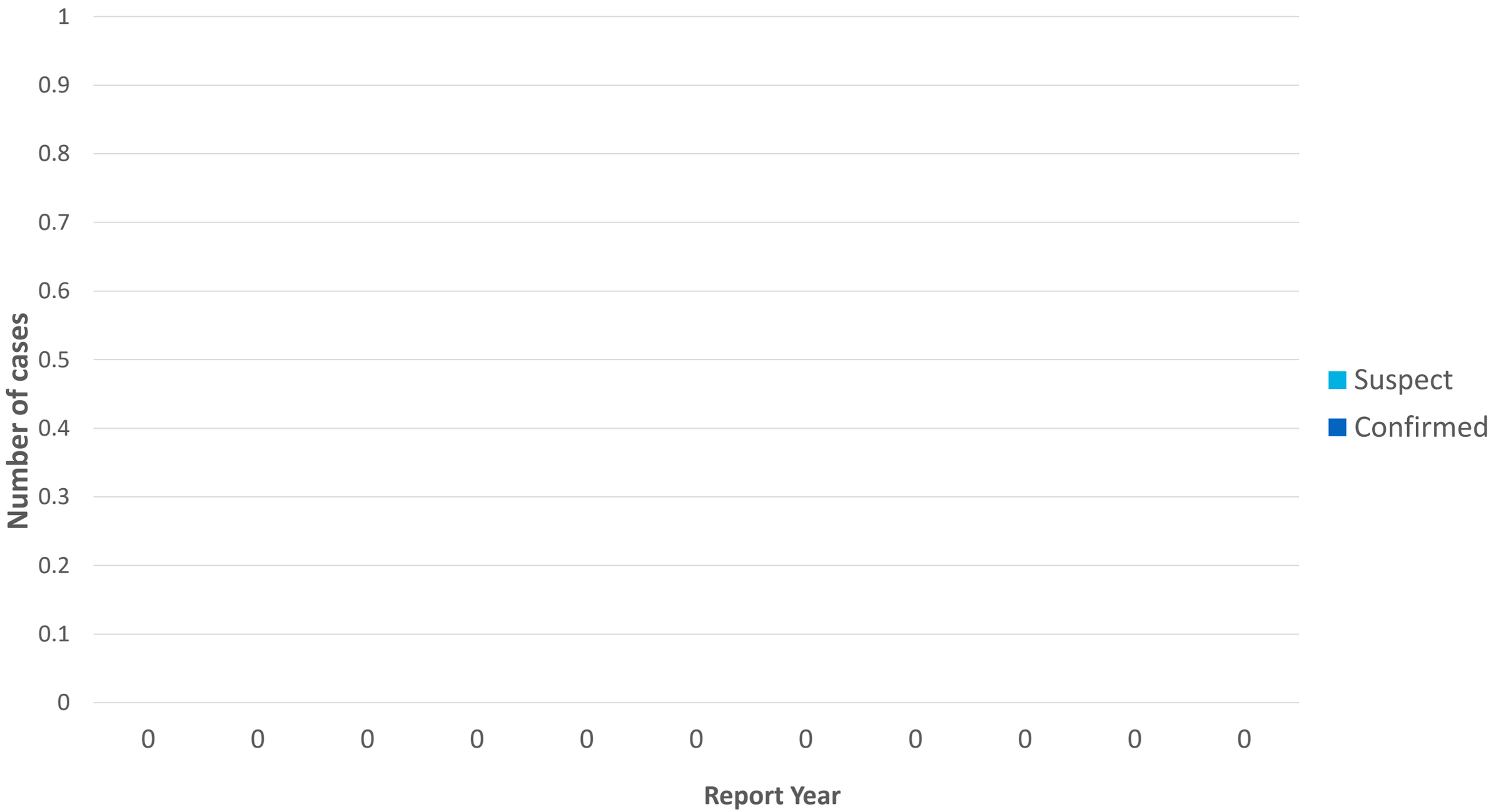
# Agenda

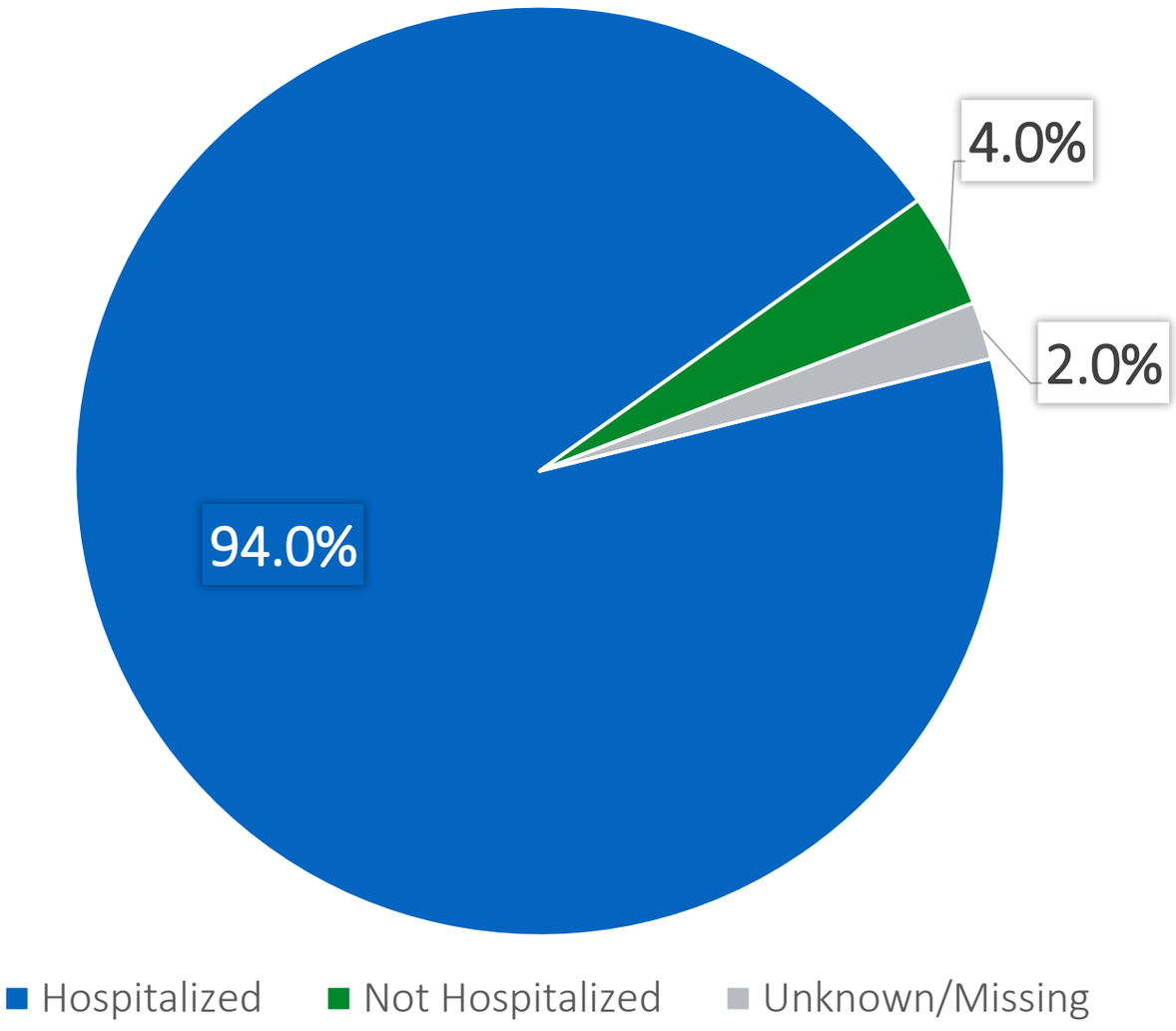
1. Colorado LD Epi
2. Pool Inspections in Colorado
3. Outbreaks
4. Questions

# Legionnaires' disease cases by case status and year
# Colorado, 2008 - 2018



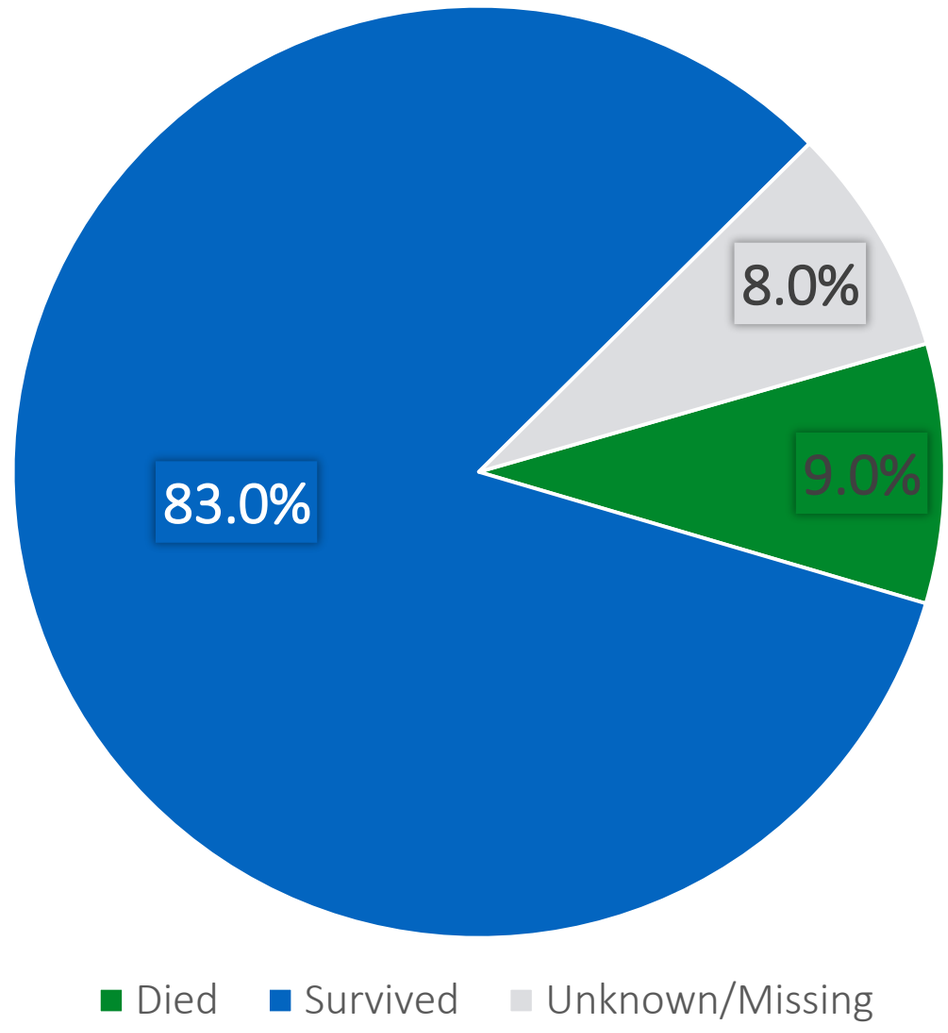
## Legionnaires' Disease Hospitalization Status
## Colorado, 2014-2018

n= 412




## Legionnaires' Disease Outcome Status
## Colorado, 2014-2018

n= 412



# Recreational Water Inspections in Colorado

## 5 CCR 1003-5, Swimming Pool and Mineral Bath Regulations

1. Not all public health agencies in Colorado have environmental health programs or perform routine pool inspections.

2. Facilities are characterized as either private (not inspected), semi-public, or public.

3. Semi-public and public facilities are required to adhere to state regulations at all times, even if they are not routinely inspected.

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AQUATIC FACILITY
INSPECTION REPORT

JEFFERSON COUNTY PUBLIC HEALTH
645 Parfet Street, Lakewood CO 80215

| ESTABLISHMENT [redacted] | ADDRESS [redacted] | DATE [redacted] |
|---|---|---|
| CITY [redacted] | ZIP [redacted] | OWNER \ MANAGER PHONE [redacted] |
| X PRE-OPENING ☐ ROUTINE ☐ FOLLOW-UP X COMPLAINT | ☐ PUBLIC POOL X SEMI-PUBLIC POOL | X YEAR ROUND POOL ☐ SEASONAL POOL | OPERATOR NAME |

| AQUATIC VENUE NAME/ DESCRIPTION | METHOD OF DISIN. | FREE DISINFECTION LEVEL | COMBINED DISINFECTION LEVEL | pH | TOTAL ALKALINITY | CALCIUM HARDNESS | TEMP | TURBIDITY | CAPACITY (GAL) | FLOW RATE (GPM) | TURN OVER (HR) | SAT. INDEX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pool | (Cl) Br | 4.12 | 0.16 | 7.48 | 84 | 164 | 84 | clear | 20,000 | unk | unk | -0.12 |
| Spa | (Cl) Br | 0.18 | 0 | 7.69 | 75 | 132 | 105 | clear | 800 | unk | unk | -0.01 |
| | Cl Br | | | | | | | | | | | |
| | Cl Br | | | | | | | | | | | |

An inspection of this establishment was made in accordance with the Colorado *Regulations Pertaining to Swimming Pools and Mineral Baths (5 CCR 1003-5)*. Violations are indicated by an (X), below. CRITICAL VIOLATIONS are GRAY SHADED and are cause for IMMEDIATE CLOSURE of the pool or spa until corrected. See reverse of this form for additional information.

| | | |
|---|---|---|
| **01** | **DISINFECTION EQUIPMENT** | |
| | a. | Manual distribution in emergency only |
| | b. | Cleanable, durable, NSF-approved, corrosion resistant |
| | c. | Chlorine gas equipment meets requirements (see reverse) |
| | d. | SCBA or canister respirator for other chemicals present |
| | e. | Proper chemical storage and handling |
| **02** | **SWIMMING POOL WATER SUPPLY** | |
| | a. | Potable water source |
| | b. | Cross connections protected |
| **03** | **WATER TESTING EQUIPMENT** | |
| X | a. | Test kit appropriate for disinfectant used |
| | b. | Thermometer available |
| X | c. | Reagents within expiration date |
| **04** | **WATER QUALITY** | |
| X | a. | Disinfection Level *(Cl ≥ 0.25 ppm or Br ≥ 2.0 ppm)* |
| | b. | *pH ≥ 7.2 and ≤ 8.0* |
| | c. | Total alkalinity *≥ 70 ppm and ≤ 180 ppm* |
| X | d. | Calcium harness *≥ 160 ppm and ≤ 600 ppm* |
| | e. | Saturation Index between *-.5 and +.5* |
| X | f. | Water temperature *≥ 77°F and ≤ 104°F [spas]* |
| **05** | **SWIMMING POOL AND SPA OPERATION** | |
| X | a. | CPO / AFO on staff or under contract |
| | b. | Pool water testing records maintained (3x daily) |
| | c. | Spa water testing records maintained (every 2 hrs) |
| X | d. | Flow meter operating |
| | e. | All other equipment operating at all times pool is open |
| X | f. | Pool turnover every 6 hours (4x per day) |
| | g. | Wading pool turnover every hour (24x per day) |
| X | h. | Spa turnover every 30 minutes (48x per day) |
| X | i. | Pool or spa free from debris or scum |

| | | |
|---|---|---|
| **06** | **HEATING AND VENTILATION SYSTEMS** | |
| | a. | Proper ventilation, no drafts |
| | b. | Heating units / outlets protected from bather contact |
| **07** | **BATHER CONTROL** | |
| | a. | Showers taken with soap and water |
| | b. | Patrons with serious cuts, abrasions or known communicable diseases excluded from pool or spa |
| | c. | Bather load less than 1 person / 24 sq.ft. for depths greater than 3.5 feet, and less than 1 person / 10 sq.ft. for all other areas of the pool. |
| **08** | **TURBIDITY (water clarity)** | |
| | a. | Main Drain Or Bottom Of Pool / Spa Visible |
| **09** | **WASTEWATER DISPOSAL** | |
| | a. | Indirect connection between pool or spa and wastewater system |
| **10** | **DISEASE CONTROL PROCEDURES** | |
| | a. | Patrons with communicable diseases excluded |
| | b. | Feces, diarrhea response plan acceptable / available |
| **11** | **FACILITY CLEANLINESS AND STATE OF GOOD REPAIR** | |
| | a. | Shower areas |
| | b. | Locker rooms |
| | c. | Toilets / sinks |
| | d. | Equipment / storage rooms |
| | e. | Pool shell / deck |
| | f. | Ladders, slides, diving boards and railings |
| | g. | Water features / spray equipment |
| | h. | Perimeter fence minimum of 60" high, picket spacing less than 4" equipped with a self-closing gate |
| | i. | No animals except service animals in pool area |
| | j. | Any other conditions (specified below) |

# Inspection Report

Few critical violations that require immediate closure of a facility

- Elevated bacterial or fecal coliform levels
- Out of range chlorine or pH
- Turbidity issues related to main drain visibility

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# First Investigation

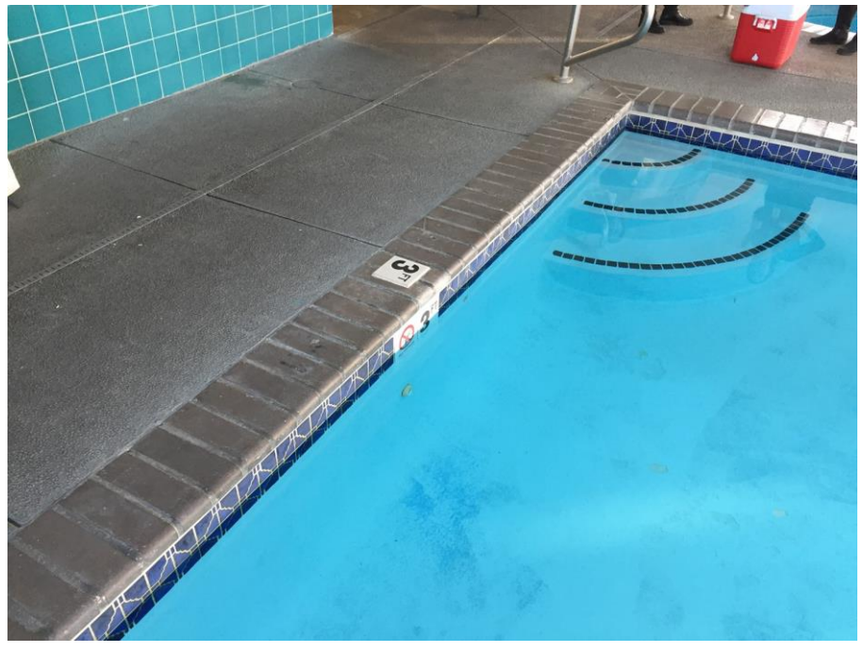
- May 10, 2016- notified of the first case; MN resident.
- November 29, 2016- Notified of the second case; CO resident.
- December 1, 2016- First environmental investigation conducted at the facility. Pool/hot tub closed.

Epidemiologists play the new CDC edition of Clue®

# Environmental Sampling Round 1

| Sample # | Culture Result | Sample Location |
|---|---|---|
| 1 | - | Pool water |
| 2 | - | Pool water line swab |
| 3 | - | Pool filter basket swab |
| 4 | - | Pool pump swab |
| 5 | - | Hot tub water |
| 6 | - | Hot tub water line swab |
| 7 | - | Hot tub jet swab |
| 8 | - | Hot tub pump swab |
| 9 | - | Guest room jacuzzi swab |
| 10 | - | Pool shower swab |

# Round 1 Pictures



# Second Investigation

- April 3, 2017- at 6:00 am the pool and hot tub are routinely inspected and both are closed due to multiple critical violations of state code. At 12:00 pm, CDPHE is notified of a third case associated with this facility; NM resident.

- April 4, 2017- Second environmental investigation conducted.

# Environmental Sampling Round 2

| Sample # | PCR Result | Culture Result | Sample Location |
|---|---|---|---|
| **1** | + | **+** | **Hot tub water** |
| 2 | + | - | Pool water |
| **3** | + | **+** | **Hot tub jet swab #1** |
| **4** | + | **+** | **Hot tub jet swab #2** |
| 5 | + | - | Hot tub water line swab #1 |
| 6 | + | - | Hot tub water line swab #2 |
| 7 | + | - | Pool water line swab #1 |
| 8 | + | - | Pool water line swab #2 |
| 9 | + | - | Rear air vent swab |
| **10** | + | **+** | **Hot tub filter basket swab** |
| 11 | + | - | Pool filter basket swab |
| 12 | + | - | Front air vent swab |
| **13** | + | **+** | **Hot tub pump swab** |
| 14 | + | - | Pool pump swab |

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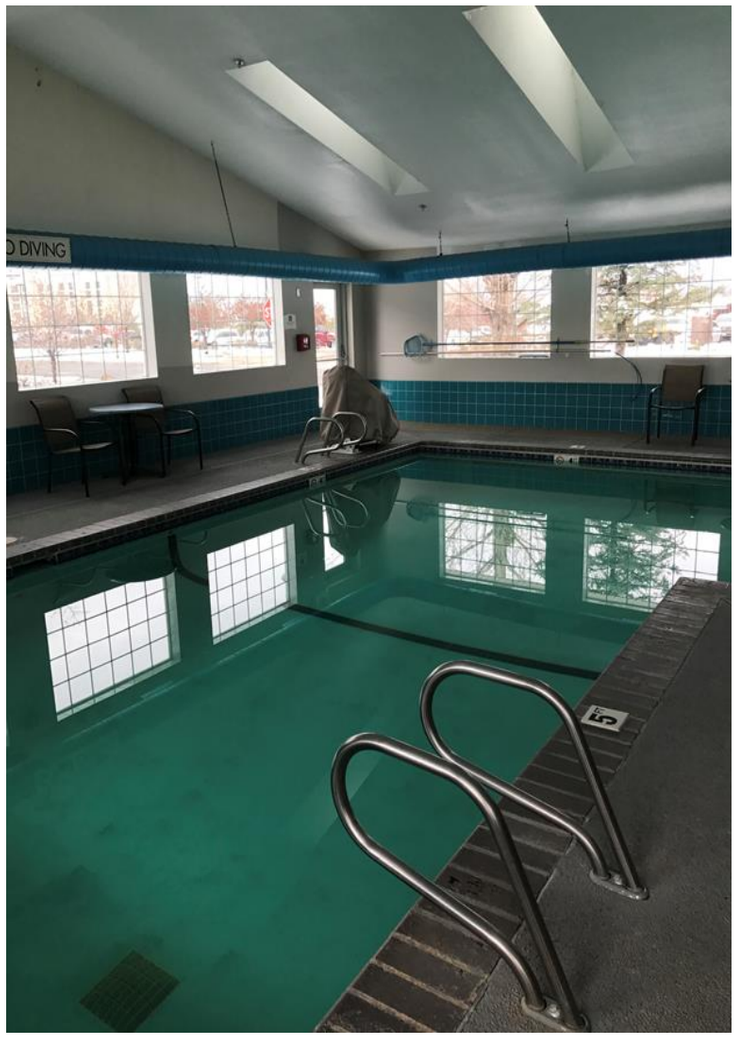
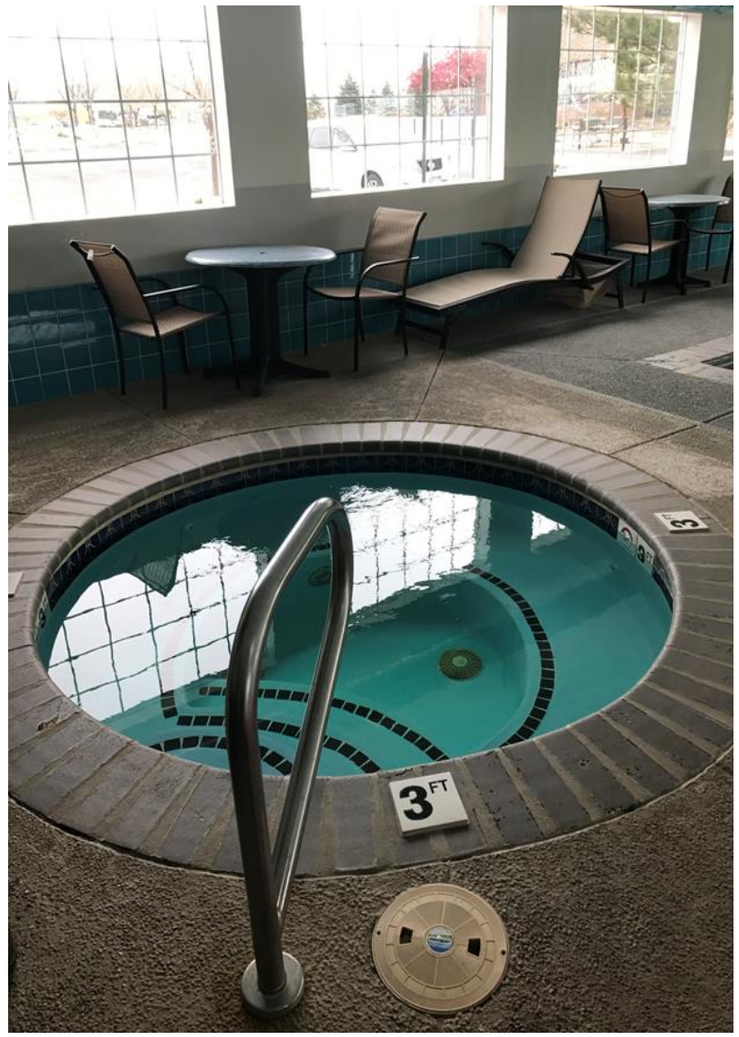
*All 19 potable water samples were negative through both PCR and culture

# Round 2 Pictures



# Hotel Pool Inspection History

Consistent closures due to **critical violations** of the Colorado Swimming Pool and Mineral Bath Regulation

- 4/4 (100%) failed inspections between February 2016 and April 2017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# Inspection Violation History

### February 2016

- Spa ph too high and visible debris
- No CPO on staff
- Maintenance records not maintained
- Flow meter not functioning
- **Pool disinfectant greater than allowable limit**

### October 2016

- No CPO on staff
- Maintenance records not maintained
- Flow meter not functioning

### June 2016

- Flow meter not functioning
- Maintenance records not maintained
- No CPO on staff

### April 2017

- Spa ph too low
- **Pool had no detectable disinfectant (Cl)**
- Alkalinity too low in pool and spa
- No CPO on staff
- Maintenance records not maintained
- Flow meter not functioning

# Epidemiologic Investigation

## Epi-X Report

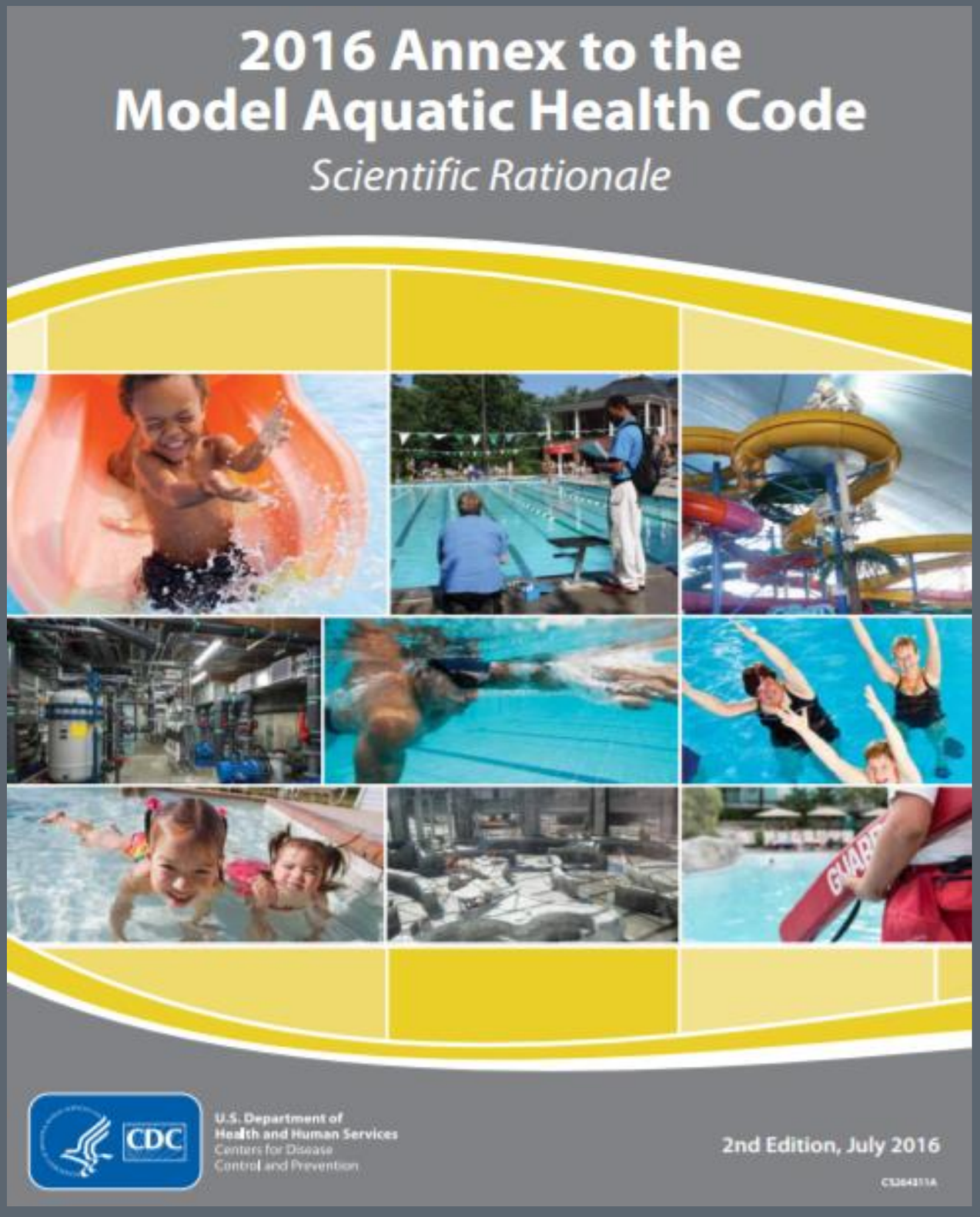
1. Report released on April 10, 2017 through the Epidemic Information Exchange (Epi-X) facilitated by the CDC
2. Notified other counties and states about this exposure

## Guest Notification

1. Received contact information for 177 guests that had recently stayed at the hotel (March 3-April 3, 2017)
2. 152/177 guests were able to be contacted
3. No additional confirmed cases were found
    - 3 suspect cases identified that developed pneumonia within 14 days of exposure to the pool or hot tub

# Case Information

| Patients | Sex | Age | Symptom onset | Case definition | Used hot tub | Used shower | Hospitalized |
|---|---|---|---|---|---|---|---|
| Case 1 | Male | 63 | 4/27/2016 | Confirmed | Yes | Yes | Yes |
| Case 2 | Female | 63 | 10/23/2016 | Confirmed | Yes | Yes | Yes |
| Case 3 | Female | 45 | 03/12/2017 | Confirmed | Yes | Yes | Yes |




# *Environmental Remediation*

- **Mitigation**
  - Complete disinfection of the system
- **Follow-up testing**
  - 6 month re-testing schedule

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# Mitigation Requirements

1. Drain hot tub (voluntarily drained the pool)

2. Scrub all hot tub and pool surfaces, skimming devices, jets, and circulation components with disinfectant

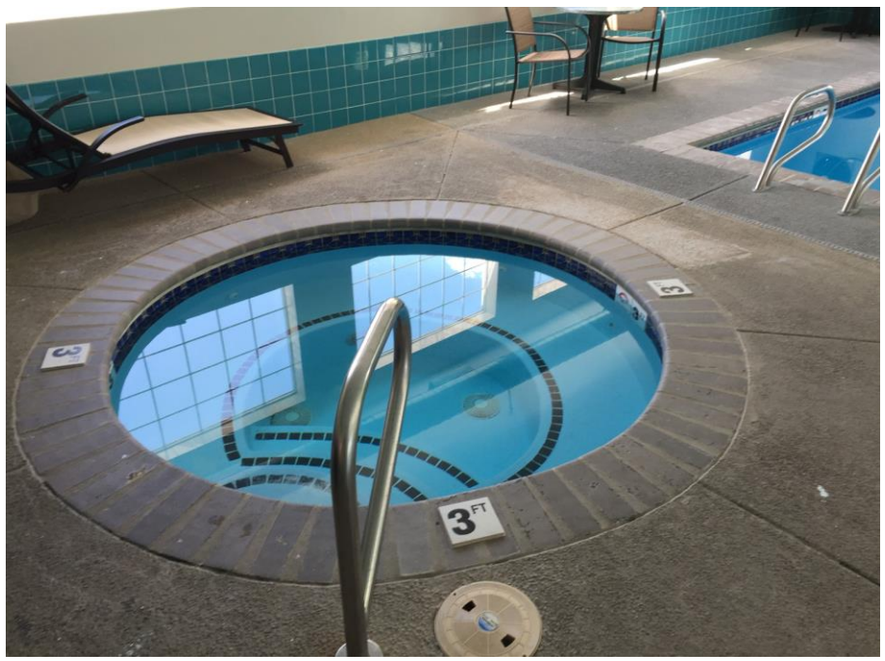
3. Replace sand filter media and service sand filter unit

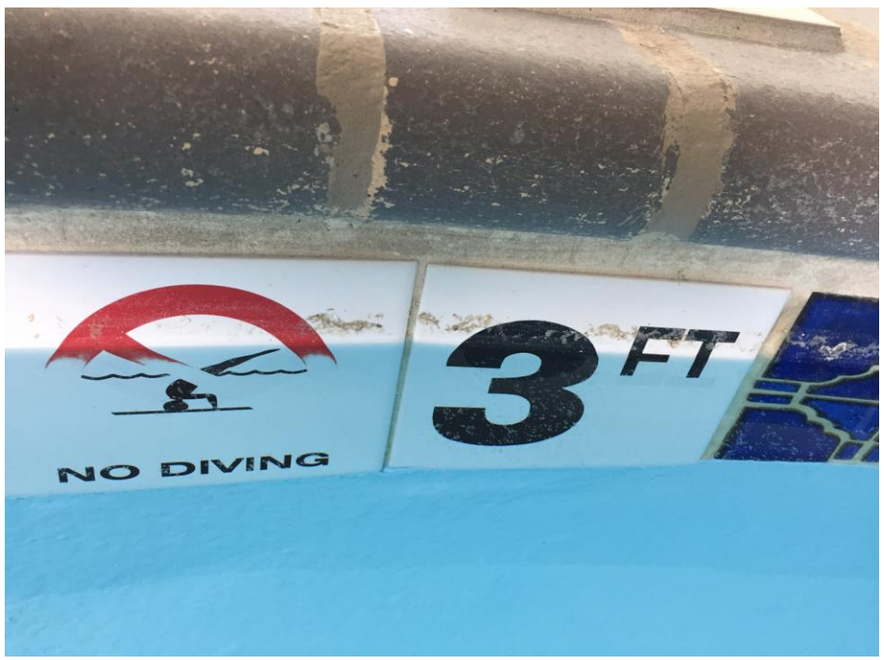
4. Inspect for and fix broken or poorly functioning components

5. Refill and superhalogenate water in hot tub and pool

6. Disinfect and/or replace both air filters

# Post-Mitigation Pictures




# Follow-Up Testing

**6 month re-testing schedule**

- Sampling every 2 weeks for 3 months, and then
- Sampling once a month for 3 months

**Conditions for re-opening**

- Negative *Legionella* culture test results
- Pass inspection by JCPH

Failed initial inspection after mitigation resulting in delayed opening

**Conditions for closure**

- Any positive *Legionella* culture test results
- Fail inspection by JCPH

Positive samples found at the end of September

Failed another inspection at the end of July

# Challenges

## Communication & Protocol

- Informing about why we were conducting an investigation
  - Response to confirmed illness, not complaints
- Reiterating the overall process and requirements
  - Ensuring proper procedures were followed
- Disagreement over investigation methods
  - Difficulty obtaining guest information
  - Messaging to guests

## Knowledge

- Education about *Legionella* and the public health impact
  - All 3 cases were hospitalized
- CPO rarely, if ever, on site
  - No one on staff who understood recreational water risks and operational standards
- Inspection history considerations and improvements

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# Outbreak #2

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# Initial Notification

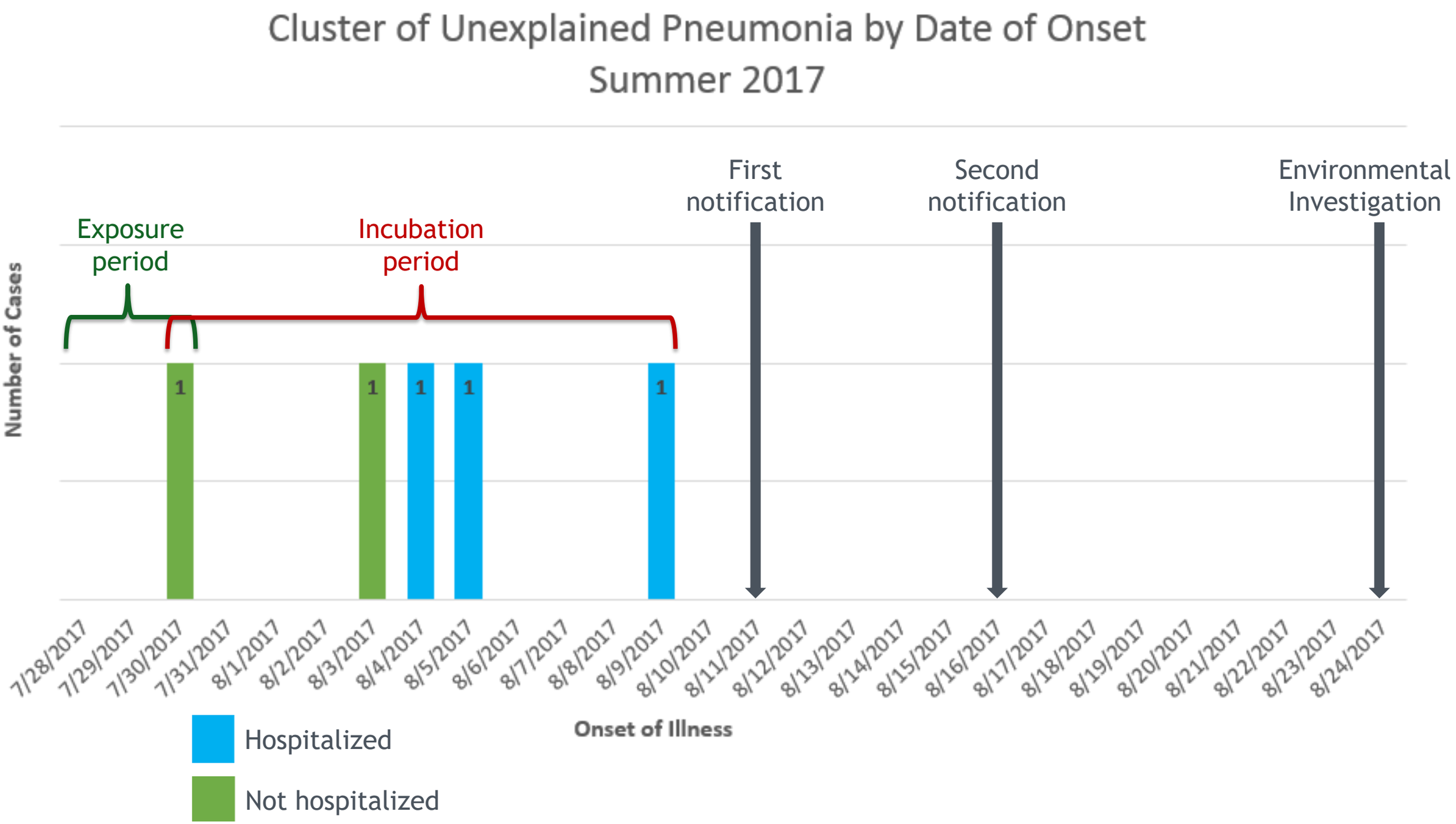
**Phone call from a VA physician**

- **Reports treating a pneumonia patient who told her that a few other people who attended the same wedding as him were also sick**

**Medical record review and interviews**

- **5 people who attended the same wedding developed pneumonia within 10 days of the event; 3 were hospitalized. Pathogen unknown but suspected to be *Legionella*.**

# Epi Curve


Cluster of Unexplained Pneumonia by Date of Onset
Summer 2017
Exposure period
Incubation period
First notification
Second notification
Environmental Investigation
Number of Cases
1
1
1
1
1
7/28/2017
7/29/2017
7/30/2017
7/31/2017
8/1/2017
8/2/2017
8/3/2017
8/4/2017
8/5/2017
8/6/2017
8/7/2017
8/8/2017
8/9/2017
8/10/2017
8/11/2017
8/12/2017
8/13/2017
8/14/2017
8/15/2017
8/16/2017
8/17/2017
8/18/2017
8/19/2017
8/20/2017
8/21/2017
8/22/2017
8/23/2017
8/24/2017
Onset of Illness
Hospitalized
Not hospitalized

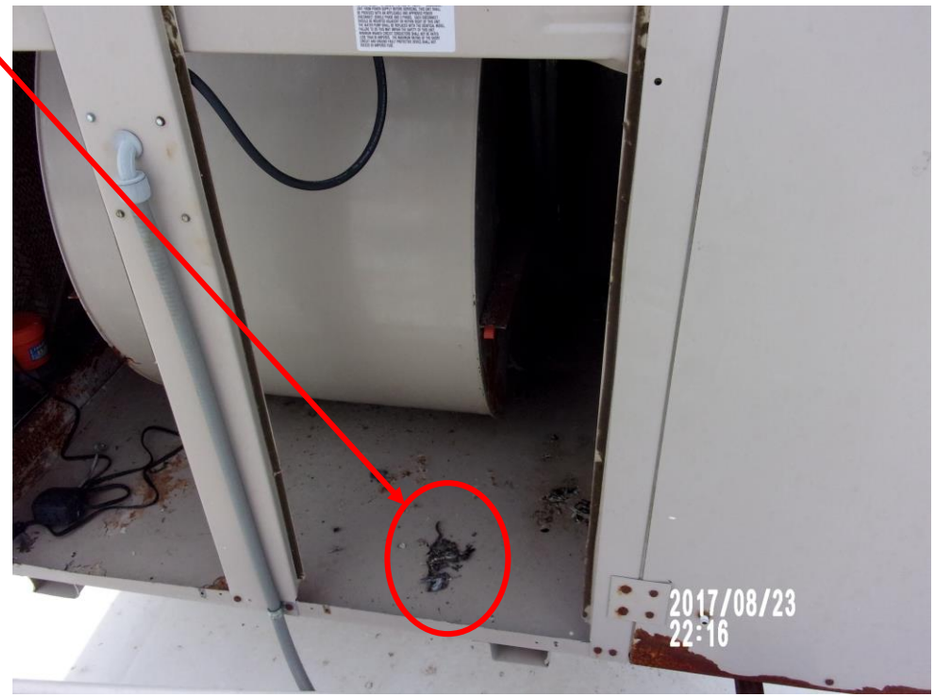
# Case Findings

| Characterization | Yes | No |
|---|---|---|
| Had pneumonia | 100% (5) | 0% (0) |
| Hospitalized | 60% (3) | 40% (2) |
| Survived | 100% (5) | 0% (0) |
| Used room shower | 100% (5) | 0% (0) |
| Went into the pool/hot tub | 60% (3) | 40% (2) |
| Spent time in the atrium | 100% (5) | 0% (0) |

# Environmental Investigation

## Rooftop Chillers/Swamp Coolers

- Rough shape; leaks, cracks, sediment…etc
- Dead bird inside one of the chillers




## Pool/Hot Tub

- Pool hadn't been drained in 5 years
- Chemical levels were way off
- Filter media hadn't been replaced in quite a while
- No CPO on staff
- No records being kept

## Potable Water System

- Problems with water heaters and water temperature
- Brown water came out of one of the showers

# Lab Results

| *Legionella* PCR | *Legionella* Culture | Sample Location |
|---|---|---|
| POS | NEG | SW Swamp Cooler Water |
| POS | NEG | SE Swamp Cooler Water |
| **POS** | **POS** | **Pool Water*** |
| POS | NEG | Pool Filter Basket Swab #1 |
| POS | NEG | Pool Filter Basket Swab #2 |
| **POS** | **POS** | **Pool Water Line Swab #1** |
| **POS** | **POS** | **Pool Sand Filter Swab** |
| POS | NEG | Pool Sand Filter Water |
| POS | NEG | Room A Shower Water |
| POS | NEG | Room B Shower Water |

# Mitigation & Follow-Up

- Mitigation was completed throughout much of the facility
  - Swamp coolers were professionally serviced and disinfected
  - Pool and hot tub were cleaned and serviced according to CDC guidelines
  - Potable water system was superheated and flushed
- Showed proof of a CPO on staff who seemed knowledgeable about pool operations
- All follow-up testing was negative for *Legionella* through both PCR and culture testing
- The pool and hot tub were re-opened after the 2.5 month investigation


**Pool**
This picture was taken during the initial sampling. It's a little hard to tell, but the water was murky. In the back of this picture in the pool is the main drain, which was not easily visible. The chlorine level was also low: 0.04 ppm.


**Rooftop Swamp Cooler**
This picture was taken during the initial sampling. Leaking water is pooled underneath. Many parts were broken or rusted out. No inspection or maintenance records available.

**Hot Tub**
This picture was taken during the follow-up sampling. The water was a mint green color, and the pH, alkalinity, and temperature were too low. Debris were found settled at the bottom.

# Epidemiologic Investigation

## Epi-X Report

1. Report released on August 28, 2017 through the Epidemic Information Exchange (Epi-X) facilitated by the CDC
2. Notified other counties and states about this exposure

## Health Alert Network (HAN)

1. Released a Colorado HAN notifying healthcare providers and local public health departments about this outbreak.
2. Provided information about Legionnaires' disease and questions to ask suspected cases.

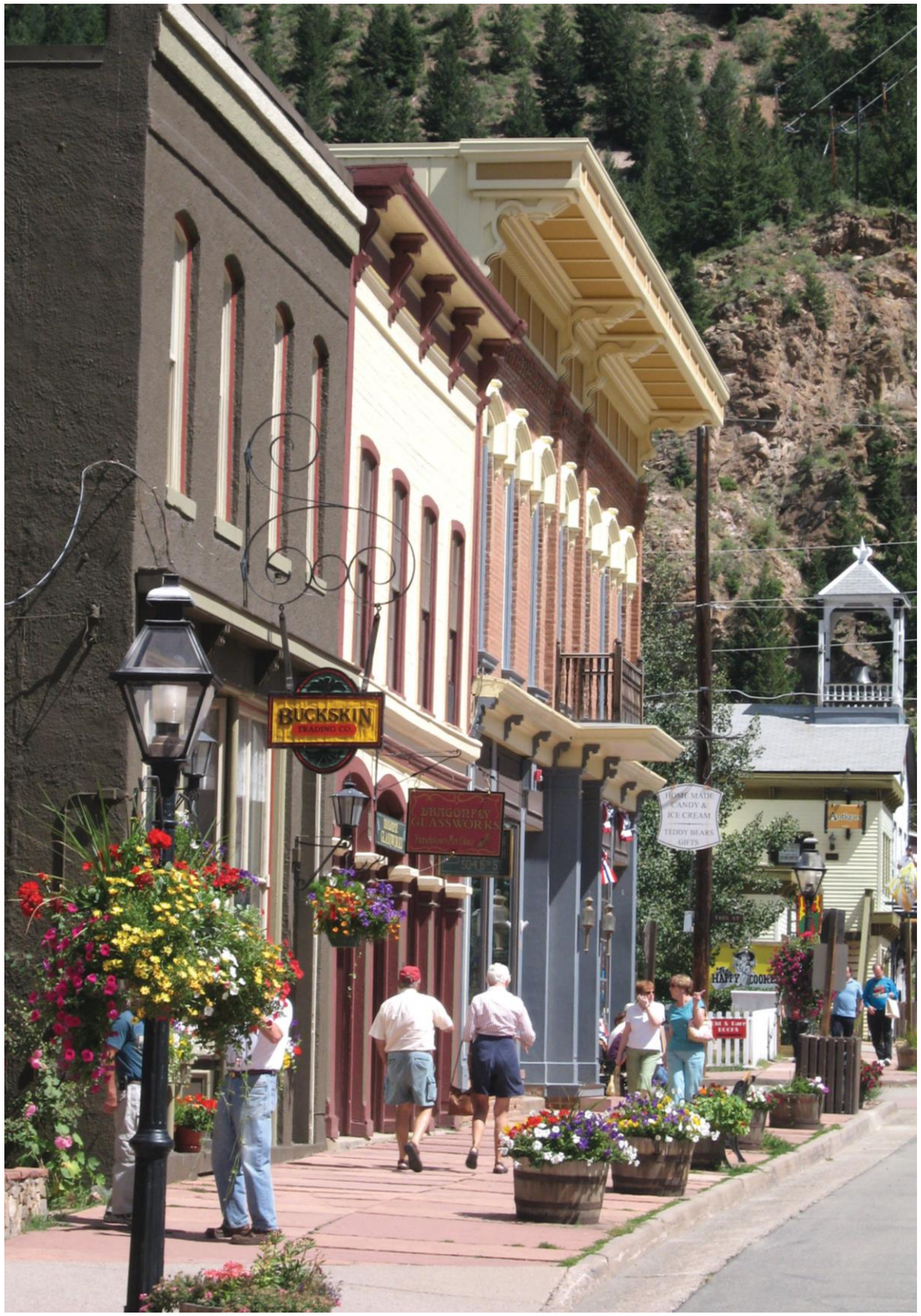
# Part 2

**October 2018:** Phone call from the regional epidemiologist in southeastern Colorado about a confirmed case and two epi-linked suspect cases of Legionnaires' Disease in folks who were at the in/near the hotel pool and hot tub during their exposure period.

- Conducted an environmental investigation at the hotel, however the hot tub was shocked with disinfectant prior to our arrival and disinfectant tabs were thrown in the pool upon our arrival.
- No *Legionella* found in the pool or hot tub, but the facility did complete an extensive mitigation.

# Challenges

- Staff were uncooperative throughout much of the investigation
- Difficulty following proper mitigation protocols and providing proof of completion
- Difficulty obtaining guest information
  - Initially would not provide guest information. Then stated they didn't know how to access their system.
  - By the time we received guest information, it had been a few weeks
    - The guest information also only included names and some phone numbers and addresses, but much of the data was blank
- Discovered conflicts of interest between local health department and hotel owner, as well as hotel owner and mitigation company


BUCKSKIN
TRADING CO.
BRIGGOFFEY GLASSWORKS
HOME MADE CANDY & ICE CREAM
TEDDY BEARS GIFTS
HAPPY COOKIES


Questions?